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10/822,647	04/13/2004	Chien-Hong Cheng	CHEN3657/EM	2982

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EXAMINER	
YAMNITZKY, MARIE ROSE	
ART UNIT	**PAPER NUMBER**
1774	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/822,647	CHENG ET AL.	
	Examiner	Art Unit	
	Marie R. Yamnitzky	1774	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 April 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-7, 10, 11, 13, 16, 17, 20, 21, 24 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Takiguchi et al. (US 2002/0100906 A1).

See the entire published application. In particular, see Fig. 1A-1C, paragraphs [0003]-[0005], [0011], [0016]-[0021], [0031]-[0042], [0056], [0061]-[0062], [0088] and [0101]-[0116].

Takiguchi et al. disclose various specific Ir complexes having present structure (II), and teach their use in a light emitting layer of an organic light emitting diode.

Each of Takiguchi's compound Nos. (1)-(5), (7)-(16), (18)-(21), (23), (24), (26), (28), (40), (46)-(48), (51)-(54), (58), (61)-(65), (70), (71) and (76)-(78) is a complex having present structure (II) as defined in present claims 1, 2, 6 and 7.

Claim 2 further defines "aryl", but does not require any of R_1-R_3 to be aryl, and further defines "heterocyclic aryl", but does not require either of R_2 or R_3 to be heterocyclic aryl. The prior art anticipates embodiments of claim 2 in which R_1-R_3 are other than aryl or heterocyclic aryl.

Claims 6 and 7 further define "X", but do not require the Ir complex to have structure (I). Structure (II) does not contain X. The prior art anticipates embodiments of claims 6 and 7 in which the Ir complex has structure (II).

Each of Takiguchi's compound Nos. (1)-(5), (7)-(16), (18)-(21), (23), (24), (26), (28), (40), (46)-(48), (51)-(54), (58), (61)-(65), (70), (71) and (76) is a complex having present structure (II) as further defined in present claim 3. Takiguchi's "Pr", "Q", "Iz", "Bz" and "Bo" are pyridine, quinoline, imidazole, benzothiazole and benzoxazole, respectively. Also with respect to present claim 3, see paragraph [0056] of the prior art, and Takiguchi's "Pz" in [0102], which is a pyrrole structure.

Various of Takiguchi's exemplary compounds defined in Table 1 meet the limitations of the Ir complex as further defined by present claims 4 and 5. Takiguchi's compound No. (47) is an Ir complex as further defined in present claim 4 wherein R_2 is methyl and R_3 is C1-C6 alkyl. Takiguchi's compound Nos. (2)-(5), (7)-(16), (18)-(21), (23), (24), (26), (28), (40), (52)-(54), (58), (62)-(65), (70), (71), (77) and (78) are Ir complexes as further defined in present claim 4 wherein R_2 is H and R_3 is C1-C6 alkyl, with the alkyl in compound Nos. (2)-(4), (52) and (62) being a methyl as further limited by present claim 5.

With respect to present claims 10, 11 and 13, Takiguchi's device examples described on page 10 have a light emitting layer in which the Ir complex is doped into CBP. CBP is a compound having hole transporting capability and is the specific compound required by present claim 13. The formula for CBP is shown on page 2 of the prior art.

With respect to present claims 16 and 17, Takiguchi's device examples described on page 10 have a hole transporting layer between the anode and the light emitting layer. The hole transporting layer comprises α-NPD, which is the compound required by present claim 17. The formula for α-NPD is shown on page 2 of the prior art.

With respect to present claims 20, 21, 24 and 25, Takiguchi's device examples described on page 10 have an electron transporting layer between the cathode and the light emitting layer. The electron transporting layer comprises Alq3, which is the compound required by present claim 25. The formula for Alq3 is shown on page 1 of the prior art. Takiguchi's device examples do not include a hole-blocking layer as required by claims 20, 21, 24 and 25, but Takiguchi et al. teach that the device structure may comprise an exciton diffusion-prevention layer between the electron transporting layer and the light emitting layer as in the device structure of Fig. 1C. Takiguchi et al. teach that BCP is known to be useful for this additional layer. BCP, which has the formula shown on page 2 of the prior art, is the compound required by present claim 21.

3. Claims 1-7, 9-13, 16, 17, 20, 21 and 23-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Hamada et al. (US 2003/0194580 A1).

See the entire published application. In particular, see paragraphs [0007]-[0010], [0014]-[0015], [0017]-[0024] and [0027]-[0041].

Hamada's general formulae (1), (3), (5) and (7) as shown in paragraph [0008] provide for Ir complexes of present structure (II). Hamada's general formulae (2), (4), (6) and (8) as shown in paragraph [0008] provide for Ir complexes of present structure (I).

Hamada et al. disclose various specific Ir complexes having present structure (I) or (II), and teach their use in a light emitting layer of an organic light emitting diode. Each of Hamada's compounds 1-4, 7-10 and 12 of the formulae shown in paragraphs [0019]-[0020] is a complex as defined in present claim 1.

With respect to present claim 2, which further defines "aryl", but does not require any of R_1-R_3 to be aryl, and further defines "heterocyclic aryl", but does not require either of R_2 or R_3 to be heterocyclic aryl, Hamada's exemplary compounds include compounds having an aryl as R_2 and/or R_3, in which the aryl is phenyl (Hamada's compounds 1-4, 9, 10 and 12) or naphthyl (Hamada's compound 9).

With respect to present claim 3, Hamada et al. provide Ir complexes wherein the nitrogen-containing heterocyclic group is pyridine (Hamada's general formulae (1)-(2) and compounds 1-4, 7, 8, 10 and 12), quinoline (Hamada's general formulae (7)-(8)), or isoquinoline (Hamada's general formulae (3)-(6) and compound 9).

Hamada's compounds 3 and 4 are Ir complexes as further defined by present claim 4 wherein R_2 is methyl and R_3 is an aryl group. Hamada's compound 3 further meets present claim 5 wherein R_3 is phenyl.

Hamada's compounds 7 and 8 are Ir complexes as further defined by present claims 4 and 5 wherein each of R_2 and R_3 is methyl.

Further with respect to present claims 2 and 5, note that "an optionally substituted phenyl group or an optionally substituted naphthyl group" are among the possibilities for R_1, R_2 and R_3 as set forth in paragraph [0009] of the prior art.

With respect to present claims 6 and 7, Hamada's compounds 2 and 8 are Ir complexes having structure (I) in which X is acetylacetonate.

With respect to present claim 9, Hamada et al. disclose devices in which the emitting layer emits yellow to red light. See the column headed "Emission Wavelength (nm)" in Tables 1-4.

With respect to present claims 10-13, the exemplary devices disclosed by Hamada et al. comprise a light emitting layer in which the Ir complex is doped in a host compound. Hamada et al. disclose four specific host compounds: CBP, TCPB, TCTA and 1AZM-Hex. See paragraphs [0022] and [0033]-[0035] for the formulae of these prior art host compounds. CBP, TCPB and TCTA have hole transporting capability as required by claim 11. 1AZM-hex has electron transporting capability as required by claim 12. CBP is the compound required by claim 13.

With respect to present claims 16 and 17, the exemplary devices disclosed by Hamada et al. comprise a hole transfer layer between the anode and the light emitting layer. The hole transfer layer is made of NPB, having the formula shown in paragraph [0021]. NPB is the compound required by claim 17.

With respect to present claims 20, 21 and 23-25, the exemplary devices disclosed by Hamada et al. comprise a hole preventive layer in contact with the light emitting layer, and an electron transfer layer between the hole preventive layer and the cathode. Hamada et al. disclose

BCP or BAlq for use in the host preventive layer, and disclose Alq for use in the electron transfer layer. See paragraphs [0023], [0024] and [0039] for the formulae for the prior art compounds. BCP is the compound required by claim 21. BAlq is the compound required by claim 23. Alq is the compound required by claim 25.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takiguchi et al. (US 2002/0100906 A1) as applied to claims 1-7, 10, 11, 13, 16, 17, 20, 21, 24 and 25 above.

Takiguchi et al. do not disclose the peak emission wavelength of, or color of light emitted by, any of the exemplary devices. However, Takiguchi et al. teach that the luminescence wavelength of the Ir complex can be controlled by appropriate selection of the groups at the positions corresponding to present R_2, R_3 and Z in order to provide wavelengths ranging from a shorter wavelength to a longer wavelength. See paragraphs [0061]-[0062]. The wavelengths for yellow to red light range from about the middle to the longest wavelengths of the visible light spectrum. Further, it is reasonable to expect that at least some of the specific complexes defined in Table 1 are capable of providing a device that emits yellow to red light. For example, iridium complexes with quinoline-containing ligands are known to emit yellow to red light. It would

have been within the level of ordinary skill of a worker in the art at the time of the invention to determine the emission characteristics of a particular complex, and to select a particular complex for use in a device based on the desired device characteristics such as color of light to be emitted by the device. One of ordinary skill in the art would have been motivated to select a complex capable of providing yellow to red light for devices in which yellow to red light emission was desired.

6. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hamada et al. (US 2003/0194580 A1) as applied to claims 1-7, 9-13, 16, 17, 20, 21 and 23-25 above.

Hamada et al. disclose general formulae that encompass Ir complexes within the scope of present claim 8, and disclose specific Ir complexes that are similar in structure to some of these complexes, but do not disclose any of the specific complexes of claim 8.

It would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to make Ir complexes other than the specific complexes disclosed by Hamada et al. in order to provide other Ir complexes suitable for use in a light emitting device as taught in the prior art. One of ordinary skill in the art at the time of the invention would have been motivated to make Ir complexes that are similar in structure to the specific complexes disclosed by Hamada et al. with the expectation that complexes that are similar in structure would be light emitting and could be used in a light emitting device. For example, one of ordinary skill in the art at the time of the invention would have reasonably expected that a compound similar to Hamada's compound 2 as shown in paragraph [0020], but having hydrogen or a methyl group instead of a

phenyl group at the position corresponding to R_2 in Hamada's general formula (2), would be suitable for Hamada's purposes based on the definition of R_2 in paragraph [0009]. Such a compound having hydrogen instead of a phenyl group at Hamada's R_2 position is a complex of present formula I-1. Such a compound having a methyl group instead of a phenyl group at Hamada's R_2 position is a complex of present formula I-10. With respect to the complex of present formula I-10, one of ordinary skill in the art also would have reasonably expected that replacing one of the three pyridine-containing ligands of Hamada's compound 3 as shown in paragraph [0020] with an acetylacetonate ligand would provide a compound suitable for Hamada's purposes since such a substitution would be equivalent to the difference between Hamada's compounds 1 and 2. The complex of present formula I-7 is also very similar to Hamada's compound 8 as shown in paragraph [0020], and other complexes within the scope of present claim 8 would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention given Hamada's general formulae (1)-(8) and definition of R_1-R_3.

7. Claims 14, 15, 18, 19 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hamada et al. (US 2003/0194580 A1) as applied to claims 1-7, 9-13, 16, 17, 20, 21 and 23-25 above, and further in view of Sato et al. (US 2002/0125818 A1).

Hamada et al. do not disclose the specific hole transporting host compound required by claim 14, the specific electron transporting host compound required by claim 15, the hole injection modification layer required by claims 18 and 19, or the specific hole blocking compound required by claim 22, but the specific compounds required by these claims are not

novel, and multilayered device structures having various layers providing different functions were known in the art at the time of the invention.

For example, Sato et al. disclose a light emitting device in which the light emitting layer comprises a phosphorescent compound such as an iridium complex, the light emitting layer further comprising at least one host material having electron transporting capability or hole transporting capability.

Sato et al. teach that carbazole compounds may be used as the host material. Carbazole compounds such as the compound of claim 14 are known to have hole transporting capability.

Sato et al. also teach that TPBI (see paragraph [0127]) may be used as a host material. TPBI is the compound required by claims 15 and 22 and is known to have electron transporting capability.

Regarding the compound required by claim 19, Sato et al. disclose that aromatic amine compounds having a starburst structure may be used in a hole transporting layer. In paragraph [0173], Sato et al. name a specific starburst aromatic amine that is an isomer of the compound of present claim 19 (the compound of claim 19 being 4,4',4"-tris(2-naphthylphenylamino) triphenylamine). Multi-layered hole injecting/transporting structures were known in the art at the time of the invention, with materials of different ionization potentials and hole mobilities being selected for different layers and arranged so as to provide a flow of holes from the anode to the light emitting layer.

With respect to the use of TPBI in the hole blocking layer as in claim 22, TPBI is a known electron transporting compound and it was known in the art at the time of the invention

that the ability of an electron transporting compound to block holes is dependent, at least in part, on the composition of the adjacent light emitting layer.

The specific compounds required by present claims 14, 15, 19 and 22 are not novel compounds. It is the examiner's position that absent a showing of superior/unexpected results, it would have been within the level of ordinary skill of a worker in the art at the time of the invention to select suitable alternative materials for use as a host material in the light emitting layer, a material for the hole injecting/transporting layer, and a material for the hole blocking layer of Hamada's device from known materials such as those disclosed by Sato et al. and similar known materials.

8. Miscellaneous:

In the last line of claim 2, "benzofurane" should read --benzofuran--.

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Sano et al. (5,432,014) demonstrate that 1AZM-Hex, used as the host material in Ex. 21 of Hamada et al. (US 2003/0194580 A1), is an electron transporting material. For example, see col. 13, line 17-c. 14, l. 16.

Thompson et al. (US 2002/0034656 A1) do not disclose any specific examples of Ir complexes of having present structure (I) or (II), but suggest such complexes in teaching that

vinylpyridines may be used for the L ligands of phosphorescent organometallic complexes (e.g. see Fig. 49).

US 6,797,980 B2 to Takiguchi et al. is related to Takiguchi's published application that is applied in this action.

US 7,022,422 B2 to Hamada et al. is related to Hamada's published application that is applied in this action.

10. Any inquiry concerning this communication should be directed to Marie R. Yamnitzky at telephone number (571) 272-1531. The examiner works a flexible schedule but can generally be reached at this number from 6:30 a.m. to 4:00 p.m. Monday, Tuesday, Thursday and Friday, and every other Wednesday from 6:30 a.m. to 3:00 p.m.

The current fax number for all official faxes is (571) 273-8300. (Unofficial faxes to be sent directly to examiner Yamnitzky can be sent to (571) 273-1531.)

MRY
September 05, 2006

Marie R. Yamnitzky

MARIE YAMNITZKY
PRIMARY EXAMINER
1774